The Fine Structure of the Newly Formed Spore of Onoclea sensibilis

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The fine structure of the dividing meiocyte of *Onoclea sensibilis* L. was described by Marengo (1977), and that of the mature spore of the closely related *Matteuccia struthiopteris* (L.) Tod. by Marengo (1973). It is of interest to establish the ultrastructure of the cells formed at the termination of the second meiotic division. Marengo (1949) reported that cytoplasmic inclusions resolvable by light microscopy apparently disappeared during spore enlargement and that proplastids and plastids made their appearance as the large vacuole was replaced by more cytoplasm. To establish the identity of cytoplasmic inclusions received from the meiocyte and to elucidate the fine structure of the young spore, an electron microscope study was made of a sporangium shown by thick sections to contain young spores just separating from the tapetum (*Fig. 1*, T).

Individual sporangia dissected from young fertile fronds were fixed in glutaraldehyde followed by osmium tetroxide and embedded in Epon (Spurr, 1969). 0.5 μm sections were cut from individual sporangia and examined by phase contrast microscopy without staining. From a sporangium identified as having spores at the desired stage, thin sections were cut with a diamond knife, stained with uranyl acetate and lead citrate, and examined with an Hitachi HU-11A EM.

Identifiable inclusions present in the young spore shown in *Figs. 1* and *2* include lipid droplets (L), amyloplasts (A), and mitochrondria (M). Small vacuoles (V) are present, as well as a loosely organized endoplasmic reticulum.

At this stage, the spore nucleus appears to have not yet reached full interphase, since a nucleolus is not present and the nuclear membrane (*Fig. 2*, NM) is poorly defined. The mature spore of this species has a nucleolus occupying fully one-third of the nuclear cross-section (Marengo, 1956).

It is hoped that the optical disappearance and re-appearance of inclusions in the enlarging spore can be followed with ultrastructural techniques. Properly buffered fixative may allow preservation of stages plasmolyzed by the fixatives of light microscopy. Older sporangia are to be dealt with in the next phase of this study.

LITERATURE CITED

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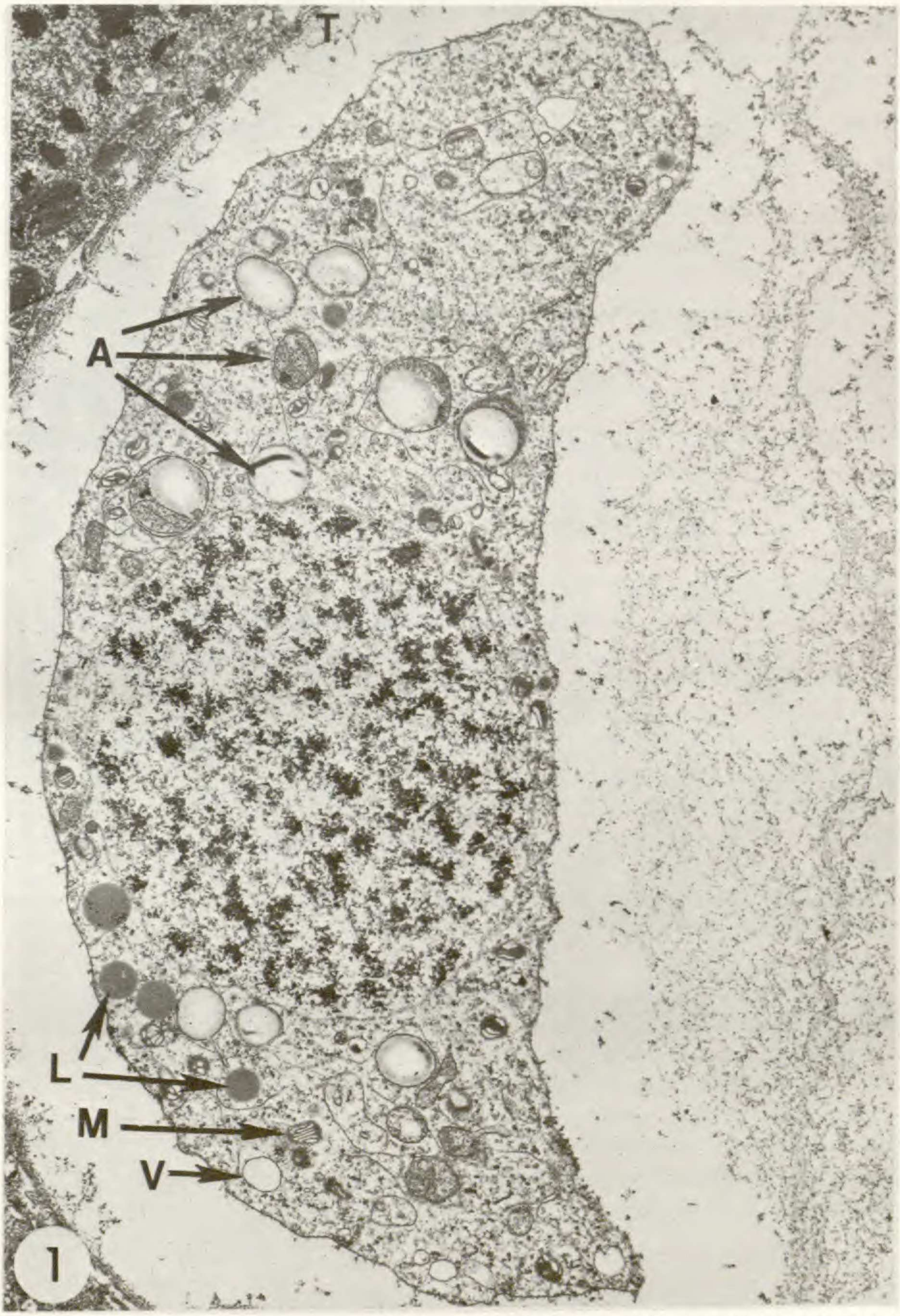

FIG. 1. Longitudinal section of a young *Onoclea sensibilis* spore, newly separated from the tapetum (T). Identifiable inclusions are amyloplasts (A), lipid droplets (L), and mitochrondria (M). Vacuoles (V) are present, and a loosely organized endoplasmic reticulum is apparent. ×11,080.

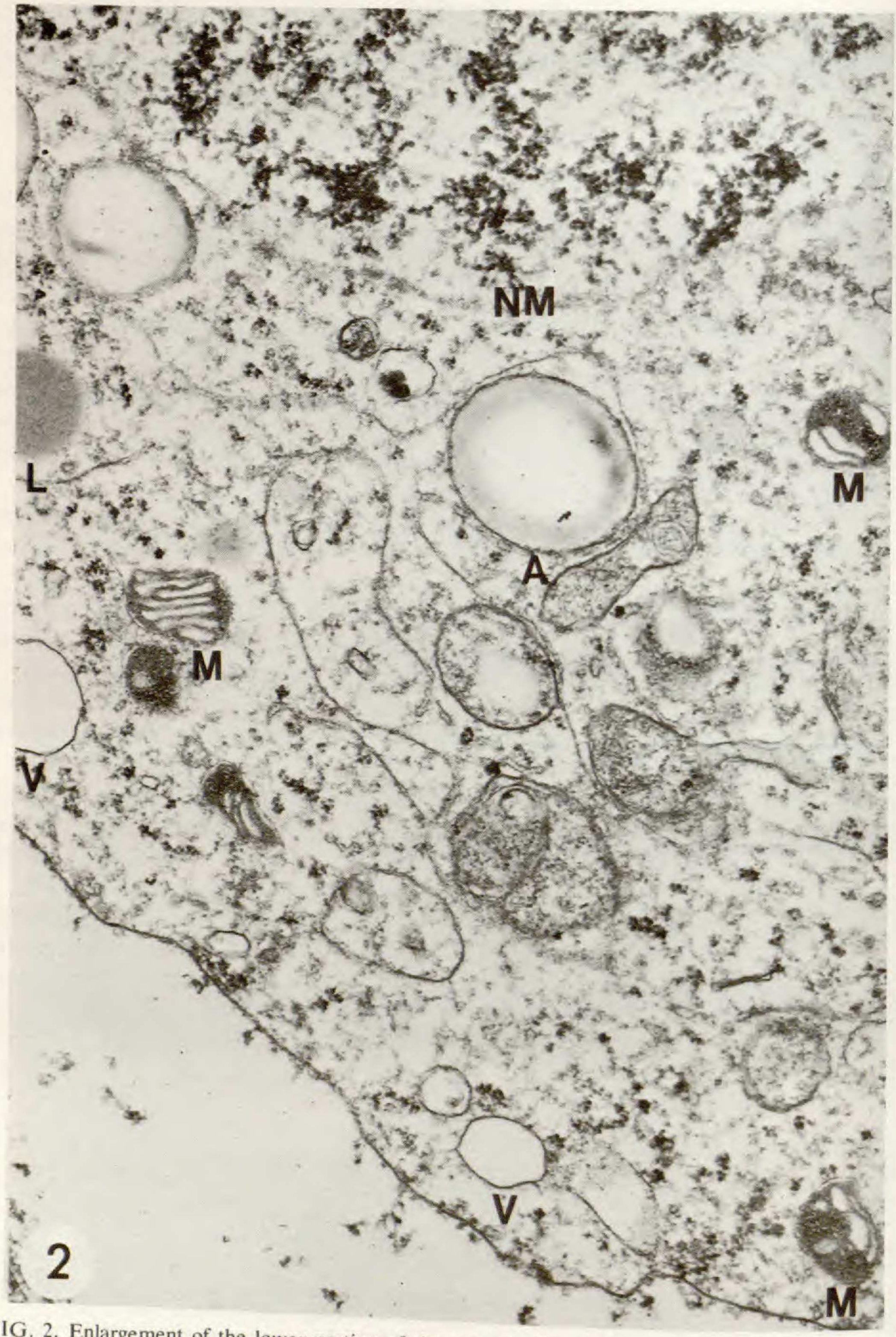

FIG. 2. Enlargement of the lower portion of the spore in *Fig. 1*. Organelles labeled as in *Fig. 1*. Nuclear membrane (NM) appears diffusely organized. Organelle adjacent to labeled amyloplast (A) is probably the surface view of a mitochrondrial crista. ×33,175.